Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of	)	
	)	
Redevelopment of Spectrum to	)	ET Docket No. 92-9
Encourage Innovation in the	)	
Use of New Telecommunications	)	RM-7981
Technologies	)	RM-8004

To: The Commission

Comments of Apple Computer, Inc.

Apple Computer, Inc. ("Apple"), hereby submits comments on the First Report and Order and Third Notice of Proposed Rule Making ("Third NPRM") in the above-referenced proceeding.

Two years ago Apple filed its Data-PCS Petition, calling for the establishment of a new radio service for unlicensed local area data communications ("Data-PCS") among people using computing devices.[1] We described the public benefits of Data-PCS in two general areas: as a means to support peer-to-peer and local resource access, and as "the first, and most important, link in the information infrastructure." We emphasized that, among other things, wireless links will be the essential "trail-head" allowing scientists, students, and business persons to connect to a national data network.

Since Apple filed its Petition, the Commission has taken far-reaching steps to put into place the regulatory framework for Data-PCS and other user-provided local area communications, much as Apple requested. The instant proceeding and its companion proceeding — ET Docket No. 92-100 — promise to address the remaining key issues.

In ET Docket No. 92-100, Apple and others have demonstrated that the amount of spectrum designated for unlicensed PCS is not yet adequate for the

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[1] Apple's Petition for Rulemaking, RM-7618, filed January 28, 1991, was subsequently consolidated into Gen. Docket 90-314.

many proposed services and the many anticipated users.[2] In this proceeding, there is a potentially more serious issue in that the Commission has not proposed a mechanism that will make any spectrum available for actual deployment of unlicensed PCS devices, because the operation of public safety and other vital fixed microwave facilities cannot be endangered by unlicensed PCS devices.

The value of unlicensed PCS devices to provide some of the functions Apple described as Data-PCS has taken on an even greater urgency in the context of a new national agenda. Today a National Information Infrastructure ("NII") is becoming a reality. In a report published January 12, 1993,[3] the Computer Systems Policy Project ("CSPP" and "CSPP Report") has brought a clear focus to the steps that must be taken to establish a NII and described the reasons for doing so.

CSPP is an affiliation of the chief executive officers of thirteen leading American computer companies: Apple, AT&T, Compaq, Control Data, Cray Research, Data General, Digital Equipment, Hewlett-Packard, IBM, Silicon Graphics, Sun Microsystems, Tandem, and Unisys. The following excerpts from the CSPP Report demonstrate the relevance of the new NII to the Commission's goals in this and in related proceedings.

> Our ability to generate and exchange information, technology, and ideas is helping us to increase output, decrease costs, improve quality, and bring new products to market. The United States has a unique opportunity to capitalize on this increasing reliance on information technology and the benefits it can bring. ...
>
> A national information infrastructure, which will be as accessible and easy to use as our existing national infrastructures, will revolutionize our ability to communicate and collaborate by erasing geographical boundaries. It will enable us to tap into our existing resources of creativity and knowledge. It will lead to the development of products and services today unimagined. It will

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[2] Apple's position on this issue, and the similar positions of many others, have been elaborated upon in filings in Gen. Docket 90-314/ET Docket 92-100, including Reply Comments filed January 8, 1993. These presentations need not be repeated here.

[3] See Appendix A, Perspectives on the National Information Infrastructure: CSPP's Vision and Recommendation for Action, Computer Systems Policy Project (Jan. 12, 1993).

> create new jobs and economic strength for individual Americans. It will accelerate the development of critical technologies. And finally, it will enable us to address more effectively many societal problems, including challenges in the area of health care, education, and manufacturing.
>
> In the future, the United States' primary resource for generating economic prosperity, improved quality of life, and global competitiveness will be our ability to quickly and efficiently generate and exchange information, technology, and ideas. ...
>
> The infrastructure of the future is a nationwide system that will allow all Americans to take advantage of our rich resources in information, communication, and computing technologies. It will link together a range of institutions and resources, from schools and businesses to libraries and laboratories. More importantly, it will link together individuals, from senior citizens and students, to health care professionals, manufacturing managers, and business people from all fields.
>
> The information infrastructure of the future will revolutionize the way individuals relate with one another by enabling us to work together, collaborate, and access and generate information without regard to geographical boundaries. It will enable fundamental changes in the way we educate our children, train and retrain our workers, earn a living, manufacture products, deliver services of all kinds, and interact with family and friends.[4]

The Commission's proposal in this proceeding is directly relevant to the recommendations of CSPP. Prompt action by the Commission is essential if the benefits of the NII, as described in the CSPP Report, are to become a reality, because all of us, not just a privileged few, must be able to access the NII. Regardless of how efficient, fast, and well designed the wide-area deployment of the NII turns out to be, the flow of information reaches a bottleneck, or even an abrupt dead end, if there is no way for individuals to access it and use its capabilities in their daily lives.[5]

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4 CSPP Report at 4.

5 The full benefits of the NII will never be realized without the possibility for wireless communications at the end user's premises. While many companies and institutions will be able to afford the cost, and accommodate the planning requirements, of hard-wiring terminals into the NII, many other potential beneficiaries will not be able to do so. As a result, they will be able to connect into the NII only if they can do so by wireless communications.

Data-PCS and other forms of wireless connectivity answer the CSPP's challenge to create capabilities that will "enable broad access by millions of Americans to public and private information resources and to enable people to generate, transmit and receive text, images, and video anywhere, at any time."[6]

The nation, moreover, cannot tolerate delays in effective use of the NII. The time to act is now and the FCC must play a key role. An appropriate, sufficient, and immediately available spectrum allocation for this purpose is essential. At present, the Commission has not proposed such an allocation.

In ET Docket No. 92-100, Apple and others demonstrated the need for 20 to 45 MHz, in addition to the 20 MHz currently proposed for Data-PCS, User-PCS, and other unlicensed PCS applications.[7] In the comments below, Apple urges the Commission to modify its proposal in this proceeding to assure the immediate availability of such a spectrum allocation. To do so, the Commission should accelerate the process of clearing all existing microwave users from the unlicensed PCS frequencies.

For example, the benefits derived by the 10 million users at hundreds of colleges, universities, high schools, libraries, community colleges, and smaller educational institutions who are currently connected through NSFNET could be dramatically enhanced by adding the potential for wireless communications by the end user to an enhanced and expanded national network. Students, researchers, and teachers would no longer be constrained by the physical network; rather, they could connect their own computer directly into the network, downloading data where, how, and to what device they need. Similarly, the availability of wireless end loops will ensure that the benefits of a national information network can be shared by all, even those who lack the resources to make the significant infrastructure investments needed for a wired network. For example, school systems would be able to take advantage of the NII with as little as a single stand-alone computer and modem, rather than having to devote physical space and hardware to each user group and physically wire each group into a predetermined network.

6 CSPP Report at 14. The CSPP Report describes such "tools for the infrastructure" as "interactive learning devices, wireless computers capable of simulating design and engineering plans on-site, and pocket size devices allowing doctors access to medical resources from remote locations." Id. at 6. The Report goes on to assert that "(t)he only thing that will limit the shape, form, and use of these [tools] is our imagination." Id.

7 See Reply Comments of Apple Computer, Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 2-4.

I. The Commission's Proposed Plan For Accommodating Public Safety Facilities Will Harm Such Services And Prevent Development Of The User-PCS Spectrum.

In the Third NPRM, the Commission reiterated "the important and essential functions, such as public safety and utility management communications, that 2 GHz fixed microwave operations now provide" and "indicated [its] intention to minimize the impact of [its] spectrum redevelopment plan on those services."[8] It therefore proposed to exempt existing 2 GHz fixed microwave operations licensed to the public safety and special emergency radio services — including state and local governments, police, fire, and medical emergency communications — from any involuntary relocation.[9]

The Commission took this action to protect public safety services from service interruptions and other disruptions associated with relocation. That action, however, was premised upon the Commission's assumption that PCS services and fixed microwave services could share spectrum.[10] Whether or not that assumption is valid with respect to future licensed PCS uses, the comments in earlier rounds of this proceeding and in companion proceedings have made amply clear there can be no sharing of frequencies between fixed microwave services and unlicensed PCS applications. Moreover, the Commission's proposal in the ET Docket No. 92-100 proceeding to select the most lightly loaded microwave frequencies for unlicensed PCS operations implicitly acknowledges that there can be no sharing.

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8 Third NPRM at ¶ 21.

9 Third NPRM at ¶ 26. There are continuing efforts to expand the reach of the "exempt" category to allow other services to hold onto their current spectrum allocations. See American Public Power Association, Petition for Clarification, ET Docket No. 92-9 (filed Nov. 30, 1992) (arguing that all state and local government licensees, not just public safety entities, should be permitted to continue to operate indefinitely in the 2 GHz band on a co-primary basis); Utilities Telecommunications Council, Petition for Clarification and/or Reconsideration, ET Docket No. 92-9, at 6-9 (filed Nov. 30, 1992) (same).

10 While the Commission did recognize that "in some instances" -- such as such unlicensed Data-PCS -- sharing "may be difficult," Third NPRM at n. 37, it did not exempt the spectrum allocated to such services from its proposal to protect public safety services from involuntary relocation.

Any attempt to co-locate fixed microwave and unlicensed PCS services within the same spectrum will create a risk of interference to the microwave services, degrading the performance of the fixed service and preventing the development of unlicensed PCS technologies. Microwave receivers are very susceptible to interference and, despite the fact that they are relatively directional, do not provide complete discrimination against an interfering signal at any axis. As a result, microwave links are coordinated to assure that no interfering signal can arrive at the receiver's antenna from another link above a specified threshold — a condition that is impossible to achieve in real time with unlicensed PCS devices that are, by design, capable of being used at any location.[11]

Thus, while seeking to protect the public safety microwave services from the rigors of relocation, the Commission has created a significantly larger problem for these essential services. Rather than forbid unlicensed PCS services, as some would have it,[12] and lose the substantial benefits of wireless connectivity, the Commission should apply the processes for involuntary relocation to public safety microwave licensees. In doing so, however, the Commission should accommodate the licensees' legitimate concerns regarding disruption of service by giving the public safety services priority access to relocation opportunities within the 2 GHz band, including government frequencies in the 1.71–1.85 GHz band.[13] Indeed,

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11 See Comments of Apple Computer, Gen. Docket No. 90-314, ET Docket No. 92-100, at 4; Comments of WINForum, Gen. Docket No. 90-314, ET Docket No. 92-100, at 3-5; Reply Comments of WINForum, Gen. Docket No. 90-314, ET Docket No. 92-100, at 3-4.

12 See, e.g., Comments of American Petroleum Institute, Gen. Docket No. 90-314, ET Docket No. 92-100, at 15-16 (FCC should require that services operating in the 1910-1930 MHz band be licensed); cf. Comments of Alcatel Network Systems, Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 2-3 (opposing reallocation of 1910-1930 MHz band until adequate safeguards are adopted to protect microwave licensees from interference); Comments of Viacom International Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 16 (FCC should consider difficulties with unlicensed PCS devices before reserving frequencies as proposed).

13 Government frequencies should be made available to public safety licensees who relocate from the FCC's 2 GHz band without any requirement that such replacement frequencies be subject to auctions. To this extent, certain legislative proposals regarding reallocation of frequencies from the federal government to the private sector would have to be changed.

access to such government frequencies could well be restricted only to public safety licensees who relocate from the FCC's 2 GHz band.[14]

In earlier comments, Apple has stated that some microwave stations can be relocated to different channels within the present 1.85–1.99 GHz bands according to a frequency-optimization plan.[15] Such a plan should be used initially to achieve quick and low-cost relocation of microwave facilities from the unlicensed PCS frequencies, with public safety users having the first priority on 2 GHz frequencies if they could not be accommodated in the 1.71–1.85 GHz government band.[16]

If public safety services remain in the 1.85–1.99 GHz band, or move to the 1.71–1.85 GHz government band, there would be no issue of system reliability presented, the cost of relocation would be only a fraction of that required for relocation to 6 GHz, and the relocation could be accomplished in a short time. The approach described above represents the most favorable means of providing for User-PCS in the short term, without risking interference or disruption to public safety microwave users.

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14 The possibility of moving public safety stations into government bands is clearly predicated upon these services sharing spectrum with fixed links in the government band. According to NTIA, "[t]he 1710-1850 MHz is the predominant federal medium capacity, line of sight, fixed service band. ... A combined total of 5539 frequency assignments are currently authorized (in this band), and out of these assignments about 4840 (87%) are in the fixed service." See Federal Spectrum Usage of the 1710-1850 and 220-2290 MHz Bands, NTIA Report 92-285, at 4-1, 4-3 (Mar. 1992).

15 Comments of Apple Computer, Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 5-6.

16 Apple estimates that there are some 100 public safety microwave users presently in the 1910-1930 MHz band identified by the Commission for unlicensed PCS applications. Moreover, Apple and many others have urged the Commission to expand substantially the amount of spectrum devoted to unlicensed operations, which would significantly increase the number of public safety microwave licensees who would have priority access to relocation within the 2 GHz band. (Apple estimates that public safety microwave users constitute between 20 and 25 percent of all licensed microwave users throughout the band in question.)

II. There Should Be No Transition Period Prior To Involuntary Relocation Of Microwave Users To Clear Frequencies For Unlicensed PCS Applications.

The Commission has solicited comments on the length of the transition period that would apply before existing microwave users would be subject to involuntary relocation procedures, including whether there should be a transition period at all with respect to the frequencies to be used for unlicensed PCS.[17] Apple long has taken the position that the relocation of existing microwave users from the emerging technologies bands should be swift, but fair to the microwave users, and is opposed to lengthy transition periods prior to the introduction of new technologies.[18] In particular, there should be no transition period imposed at all with respect to the frequencies selected for introduction of unlicensed PCS technologies.

As set out fully above, Data-PCS and other User-PCS technologies are essential building blocks of the NII and new peer-to-peer computer usage. Any undue delay in the introduction of these technologies represents further lost opportunities in bringing the power of "anytime, anyplace" information and communications connectivity to the classroom, to the workplace, and to the home. Delay also places the United States further behind other countries, who are not so solicitous of fixed microwave technology or so laggard in introducing new technologies. Even without a transition period, those seeking to introduce unlicensed PCS technologies are faced with an expensive and time-consuming exercise to clear all microwave users from the frequencies, since sharing is not possible.[19]

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17 See Third NPRM at ¶ 27.

18 See, e.g., Reply Comments of Apple Computer, Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 5, 8; Comments of Apple Computer, Inc., Gen. Docket No. 90-314, ET Docket No. 92-100, at 5-6; Reply Comments of Apple Computer, Inc., ET Docket No. 92-9, at 4-6.

19 Contrary to the claims of several commenters in this proceeding, there are no regions within the United States in which User-PCS will not operate and microwave users therefore can continue to operate. Scientists, educators, businesspersons, authors, and others will take their User-PCS devices wherever their interests dictate -- including to locations far from city centers. Cf. Robert Calem, "The Network of All Networks," New York Times, at 12 (Dec. 6, 1992)

Even without the additional obstacle of a transition period, all microwave stations, including public safety stations, have to be cleared from the allocated frequencies nationwide. This amounts to some 430 stations in the 20 MHz presently proposed for unlicensed PCS. Since a substantial additional unlicensed allocation is required, there could be roughly 2,600 stations that would have to be relocated.[20]

The manufacturers and other interest groups who are preparing products and technologies for the unlicensed frequencies will have to negotiate with and compensate microwave licensees to clear the frequencies. In the case of public safety microwave licensees, appropriate arrangements will have to be made to give them access to government frequencies, as discussed above. Finally, the resulting agreements and arrangements will have to be implemented and microwave stations relocated.[21]

This is a formidable, albeit essential, task. It can be accomplished in phases while protecting the interests of the microwave users. In the first phase, all microwave users should be moved from the 1910-1930 MHz band that the

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(describing explorer's use of Internet system to communicate with elementary and high school students from the Canadian Arctic).

[20] In this regard, the key to implementing a cost-effective and practically feasible relocation process will be the adoption of phased relocation, beginning by moving certain microwave stations within the 2 GHz band – both the FCC's and the federal government's – in accordance with the type of frequency optimization plan that Apple has referred to herein and in its comments in related proceedings. Cost estimates in the public record for relocating microwave stations from the 2 GHz band to the 6 GHz band or some other frequency domain range from $100,000 to $250,000 each. Thus, relocating the some 430 stations in the 1910-1930 MHz band that Apples proposes for immediate clearing for unlicensed usage, would cost from $43 to over $100 million. To relocate a total of some 2,600 stations to clear 40 MHz, the cost could easily exceed one-half billion dollars and require several years. Apple estimates the costs of reassigning stations within the 1710-1990 MHz band to be in the range of $3,000 to $10,000 per transmit/receive site, and the time could be greatly compressed. Apple believes that some combination of these approaches may prove optimal.

[21] As Apple noted in its Reply Comments in Gen. Docket No. 90-314, ET Docket No. 92-100, the Commission should provide for the immediate development of unlicensed PCS by adopting an interim mechanism for limited developmental authority for operation of certain classes of User-PCS applications that ultimately could become unlicensed when the full unlicensed band is completely cleared.

Commission has proposed for unlicensed PCS, while a "reserve" of some 20 to 45 MHz additional frequencies should be earmarked for unlicensed use, but not cleared. Those 1910-1930 MHz band microwave users who wish to move to 6 GHz frequencies immediately will be reimbursed for doing so. If public safety users have access to government frequencies, they can move there permanently and will be reimbursed for doing so. If they wish to move elsewhere in the 1.85–1.99 GHz band and remain there permanently , an optimized frequency plan to this effect will be implemented and they will be reimbursed for doing so.

If non-public safety users wish to relocate within 1.85–1.99 GHz band for an interim period, the same optimized frequency plan adopted to accommodate the public safety users permanently could be employed to provide interim relief in the 1.85–1.99 GHz band for the non-public safety users. They would be reimbursed for the interim move within the 1.85–1.99 GHz band, as well as for the subsequent permanent relocation out of the band.

In the second phase, the reserve comprised of the 20 to 45 MHz additional frequencies would be cleared in the same manner. Given the larger numbers involved, the 2 GHz optimized frequency plan would be applied uniformly throughout the PCS frequencies to both licensed and unlicensed frequency usage. The timing of the start of the second could be tied to the transition period that the Commission applies to the licensed PCS spectrum usage.

CONCLUSION

The phased implementation of both unlicensed and licensed new technologies will require resolve on the part of the Commission and widespread cooperation on the part of the affected industries. If the effort is not made, the Commission's goal of creating an opportunity for the introduction of new spectrum-based technologies will be lost and with it the greater opportunity to improve productivity, education, and well being of our citizens in the coming years.

Respectfully submitted,

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What Is CSPP?

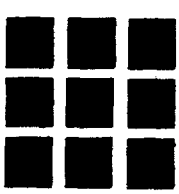
The Computer Systems Policy Project (CSPP) is an affiliation of chief executive officers of American computer companies that develop, build, and market information processing systems and software. CSPP's members include the chief executives of Apple, AT&T, Compaq, Control Data Systems, Cray Research, Data General, Digital Equipment, Hewlett-Packard, IBM, Silicon Graphics, Sun Microsystems, Tandem, and Unisys.

Upon forming CSPP in 1989, the CEOs made a commitment to work together to develop and personally advocate public policy positions on trade and technology issues that affect their industry, all high-technology industries, and hence, the nation. That commitment continues today.

To date, CSPP has issued the following reports which outline the CEOs' positions on a variety of issues.

- *Perspectives on Market Access and Antidumping Law Reform*, May 1990.
- *Success Factors in Critical Technologies*, July 1990.
- *Perspectives on U.S. Technology Policy, Part I: The Federal R&D Investment*, February 1991.
- *Perspectives on U.S. Technology Policy, Part II: Increasing Industry Involvement*, February 1991.
- *Expanding the Vision of High Performance Computing and Communications: Linking America for the Future* (Report and 7-Minute Video), December 1991.
- *Perspectives on U.S. Technology and Trade Policy: The CSPP Agenda for the 103rd Congress*, October 1992.

For copies of these reports or for more information about CSPP, please contact Pam Fandel at (202) 662-8403.



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Computer Systems Policy Project

January 12, 1993

A LETER TO POLICYMAKERS

As America looks towards its future, we believe we must take bold steps to put our strengths to work in finding ways to rekindle economic growth, remain competitive abroad, and create the kinds of jobs that will enable Americans to raise their standard of living. We believe that a national commitment to creating a national information infrastructure is one of the bold steps we need to take.

The public and private sectors have important roles in building an information infrastructure that will dramatically change the way Americans live, work, and educate themselves. While the development and deployment of the infrastructure must be led by the private sector, the federal government can accelerate its implementation by acting as a catalyst and coordinator.

We are pleased to present you with our report outlining CSPP's vision of a national information infrastructure and recommendations for action that will help to make our vision a reality. We look forward to working with the new Administration, the 103rd Congress, and a wide range of industries and academic institutions to accelerate the creation of an information infrastructure.

We look forward to working with you on this and other important issues in the months ahead.

Sincerely,

John Sculley
Apple Computer

Robert Palmer
Digital Equipment

Robert E. Allen
AT&T Corporation

John A. Young
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Enclosure

Perspectives on the National Information Infrastructure:

CSPP's Vision and Recommendations for Action

The Computer Systems Policy Project
January 12, 1993

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Executive Summary

As the 21st century approaches, our nation's challenge is to find ways to rekindle economic growth, remain competitive abroad, and create the kinds of jobs that will enable Americans to raise their standard of living. This will require that we be more productive and innovative than our competition abroad, and that we act more quickly and more efficiently.

Across a range of industries, Americans are increasingly turning to information technology to do just that. Our ability to generate and exchange information, technology, and ideas is helping us to increase output, decrease costs, improve quality, and bring new products to market. The United States has a unique opportunity to capitalize on this increasing reliance on information technology and the benefits it can bring.

We are currently the world leader in computing and communications technologies, yet we have not taken steps that will allow us to make the most of our potential. This report calls for concerted efforts by the U.S. public and private sectors to develop and deploy an advanced information infrastructure that will put our information technology advantage to work for all Americans.

Throughout history, the United States has been successful, in part, because we have taken bold steps to make our national resources available to individual Americans by creating a variety of underlying foundations or infrastructures. Our transportation, telephone, electric power, and water systems are all solid examples of this tradition. By developing the infrastructures to make these resources readily accessible to individual Americans and easy to use, we have experienced an economic prosperity, quality of life, and global competitiveness virtually unmatched by any nation. We need to build on this tradition to carry us into the 21st century.

A national information infrastructure, which will be as accessible and easy to use as our existing national infrastructures, will revolutionize our ability to communicate and collaborate by erasing geographical boundaries. It will enable us to tap into our existing resources of creativity and knowledge. It will lead to the development of products and services today unimagined. It will create new jobs and economic strength for individual Americans. It will accelerate the development of critical technologies. And finally, it will enable us to address more effectively many societal problems, including challenges in the areas of health care, education, and manufacturing.

The call for a national information infrastructure builds upon the High Performance Computing and Communications (HPCC) Program. The HPCC Program is an excellent first step. It provides an initial research foundation to create a more extensive information infrastructure that will be broadly accessible to the public and capable of meeting a wide variety of information needs. Nevertheless, it alone is not enough. CSPP believes the United States must make a national commitment to create a new national information infrastructure that complements, builds upon, and delivers the advantages of the research being performed in the HPCC Program, enabling the private sector to create new services that will benefit individuals in all walks of life. This will require improving upon and linking together current communications, computing, information, and human resource capabilities. More importantly, it will require developing new capabilities to enable broad access to a variety of public and private information resources. Finally, it will require the integration of a range of computing and communications technologies to enable transmission of text, images, audio, and video to anyone, anywhere, at any time.

CSPP believes the first step is to develop a consensus vision — across industries and with the government — of what the information infrastructure should be. It will also require building a widespread understanding of the benefits this infrastructure could bring to individual Americans. On the following pages, CSPP presents its vision of the national information infrastructure (NII). In addition, CSPP recommends the following actions be taken by the new Administration, Congress, and U.S. industry:

Summary of Recommendations

Administration Agenda

1. Make the NII a National Technology Challenge
2. Establish a National Information Infrastructure Council
3. Establish an NII Implementation Entity
4. Invest in Research for an NII
5. Fund Pilot Projects to Demonstrate Technologies
6. Develop a Public Education Program
7. Make Government Information Easily Accessible

Legislative Agenda

1. Authorize a National Information Infrastructure Council and Appropriate Funds for its Operation
2. Authorize and Appropriate Funds for Research and Technology Demonstrations

Industry Agenda

1. Continue Investments to Develop and Deploy an NII
2. Continue to Invest in Research and Development of Applications
3. Reach Out to Other Industries
4. Promote NII Efforts
5. Develop and Participate in Pilot Projects
6. Develop NII Goals and Milestones

Finally, CSPP believes the public policy principles outlined at the end of this report must be addressed jointly by the private sector and government before the information infrastructure of the future can become a reality.

Background

In December 1990, the CEOs of CSPP met with Administration officials to discuss their public policy positions on technology issues. At that meeting, CSPP was asked to assess the High Performance Computing and Communications (HPCC) Program and provide recommendations to increase industry's involvement and interest.

On December 3, 1991, after almost a year of review and analysis, CSPP issued its report and video, "*Expanding the Vision of High Performance Computing and Communications: Linking America for the Future*," concluding that the HPCC Program is a significant and critical undertaking. It would, CSPP determined, advance research in high performance computing and networking technologies as well as increase the use of high performance computers to solve important science and engineering problems. At the same time, CSPP observed that the HPCC Program could provide a foundation for something more. If properly designed, HPCC research could advance the development of technologies to help solve a wide range of social and economic problems and improve the competitiveness of U.S. industry by providing the foundation for a national communications and information infrastructure.

CSPP continues to support the HPCC Program and believes it should remain a national research priority. CSPP applauds the recent creation of a new, improved management structure for the Program, which will provide a clear mechanism to coordinate, manage, and govern the implementation of the Program and a central point for private sector interaction. In addition, CSPP commends Senator Al Gore and Representative George Brown for introducing the Information Infrastructure Technology Act in the summer of 1992 to move the HPCC effort to a new level.

The research and technology advancements supported by the HPCC Program remain a high priority for CSPP. In October 1992, in the *CSPP Agenda for the 103rd Congress*, we recommended enhancing and expanding the HPCC research agenda to: 1) provide the foundation for an information and communications infrastructure of the future; 2) bring the benefits of HPCC technology to individual Americans in areas such as health care, education, and manufacturing; and 3) develop technology demonstration projects.

In addition to supporting the HPCC Program, CSPP believes the nation must focus on creating the information infrastructure for the future. Together, the HPCC Program and the NII will provide the means to address the difficult challenges the nation now faces. HPCC research advancements will pave the way for the applications a national information infrastructure will make possible, and the infrastructure will provide a vehicle to deliver the benefits of HPCC research. The following report describes our vision for the infrastructure and recommendations for action that will help to make the vision a reality.

Introduction

Information in the 21st Century

In the future, the United States' primary resource for generating economic prosperity, improved quality of life, and global competitiveness will be our ability to quickly and efficiently generate and exchange information, technology, and ideas.

Increasingly, across a range of industries from banking and retail to automotive and aerospace, information technology has become instrumental in product development, manufacturing, marketing, sales, and service. The flow of information has become the foundation for improving productivity and increasing innovation in most every business enterprise. U.S. industry is not, however, the only beneficiary. Information technology continues to become an increasingly integral part of the every day lives of individual Americans.

The information infrastructure of the future will revolutionize the way individuals relate with one another by enabling us to work together, collaborate, and access and generate information without regard to geographical boundaries.

Automated tellers, airline reservation systems, anti-lock brakes, and personal computers are just a few examples.

As we face the 21st century, we have an advantage over our foreign competitors. We currently lead the world in computing and communications technologies. But to make the most of the increasing reliance on information technology and our current strengths, we, as a nation, need to take the bold step of developing and deploying an advanced information infrastructure that will help us remain more productive and more innovative than our competitors abroad.

The National Information Infrastructure

What Is It?

The infrastructure of the future is a nationwide system that will allow all Americans to take advantage of our rich resources in information, communication, and computing technologies. It will link together a range of institutions and resources, from schools and businesses to libraries and laboratories. More importantly, it will link together individuals, from senior citizens and students, to health care professionals, manufacturing managers, and business people from all fields.

The information infrastructure of the future will revolutionize the way individuals relate with one another by enabling us to work together, collaborate, and access and generate information without regard to geographical boundaries. It will enable fundamental changes in the way we educate our children, train and retrain our workers, earn a living, manufacture products, deliver services of all kinds, and interact with family and friends.

Throughout its history, the United States has followed a tradition of creating underlying national foundations — infrastructures — that have fostered a quality of life in America unmatched by any nation. Our transportation, electric power, and water systems are all solid examples of this tradition. As we move into the 21st century, these existing infrastructures will continue to be important, but they, alone, will no longer be sufficient to meet our national needs.

Today, we think nothing about turning on a faucet and immediately getting hot water for a shower, flipping a switch and getting electricity to

make coffee, and another switch to get a weather report. We pick up the telephone without a second thought. We must create an advanced information infrastructure for the future that will provide Americans with the same easy access to all sorts of information and people.

The information infrastructure, used in conjunction with a collection of "information appliances" — tools that will combine computing, communications, and video technologies, for example — will give people in rural areas ready access to libraries, museum exhibits, job information, and medical care now only available to those who live near those resources. People all over the country will be able to work and interact with others, without even knowing their collaborators' locations. By making information resources readily available and easy to use, the information infrastructure of the future will revolutionize our ability to access the information we need and our ability to collaborate and cooperate with others.

This infrastructure will integrate four essential elements — communications networks, computers, information, and people — to create a whole new way of learning, working, and interacting with others. A more detailed description of the elements of the infrastructure includes the following:

Communications Networks

- a network of interconnected and interoperable public and private communications networks ("public" networks refer to those networks, such as the public switched telephone network, that are open to use by anyone; "private" networks refer to those that are limited to use by a specific group of people meeting certain criteria, such as corporate networks), providing services ranging from high to low speed, allowing a range of uses anytime, anywhere;

- agreed-upon technical standards for piecing together the network, having all its pieces work together, and plugging into it;

- the capacity to transmit information, at both high and low speeds, in a variety of data formats, including image, voice, and video; and

- multiple mechanisms, perhaps including digital signatures, to support the electronic transfer of funds in exchange for services received.

Computers

- high-performance computers resident on the communications networks to provide intelligent switching and enhanced network services;

- powerful personal computers and work stations — including machines that respond to handwritten or spoken commands and portable, wireless devices — that are easy to use and mask the complexity of the underlying system so people can tap into it as easily as they dial a phone; and

- distributed computer applications that are widely accessible over the network (which acts like a lending library) and that help people perform a wide variety of tasks quickly and easily.

Information

- public and private databases and digital libraries that include material in video, image, and audio formats; and

- information services and network directories that assist users in locating, synthesizing, and updating information.

People

- people of all ages and backgrounds who are easily able to use the rich and varied resources available through the infrastructure to improve how they learn, live, and work; and
- people who create, package, communicate, and sell information in the many new ways made possible by the existence of the information infrastructure.

Why Is It Important?

The investments the nation has made over the years to develop our existing transportation, communications, and energy distribution infrastructures were instrumental in making the United States an economic and political world leader. They were also instrumental in improving the quality of life for individual Americans. To remain an economic power in the 21st century, the United States must have in place an infrastructure that allows us to compete in the Information Age by providing a tool to be continually more productive and innovative.

An information infrastructure will enable the U.S. to tap into the vast resources of knowledge and creativity that already exist in this country. As the volume and complexity of our information resources has increased, it has become almost impossible for any individual or business to take full advantage of what is available. An information infrastructure will make the benefits of information technology as available to individual Americans as the transportation infrastructure made available the benefits of automotive technology and the communications infrastructure made available the benefits of telephone technology. It will create new opportunities for the development of products and services we cannot even begin to imagine today, creating new jobs and economic strength for Americans and providing a resource for our current workers to continuously improve and upgrade their job skills.

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In addition, an information infrastructure will accelerate the development of critical U.S. technologies. A strong consensus exists as to what technologies bolster the competitiveness of our economy and where we stand in those technologies relative to the rest of the world. Initiatives to develop, deploy, and use an information infrastructure will create a market demand for many of these technologies, spurring an increase in private sector investment. Moreover, these technologies would be put to work in the real world, a testing ground more powerful than the laboratory and with the potential to directly benefit individual Americans by generating advancements in commercially relevant technologies and creating an infrastructure they can use.

Finally, the information infrastructure will lead to the development of a range of new "information appliances" that will allow Americans to tap into the resources of the infrastructure in ways beyond our understanding today. Some of these tools for the infrastructure could include interactive learning devices, wireless computers capable of simulating design and engineering plans on-site, and pocket size devices allowing doctors access to medical resources from remote locations. The only thing that will limit the shape, form, and use of these appliances is our imagination.

Why Should The United States Act Now?

Today, many of the changes taking place in our economy and influencing our competitive position are driven by the advent of the information age and the new set of economic ground rules this has created. In the information age, the value of the products and services we exchange is increasingly a function of their information content and the knowledge used to create them rather than the raw materials used to produce them. Because of this shift, the ability to easily access and share information and stimulate the creation of new ideas is essential to maintaining a strong economy, developing world class industries, and enhancing the quality of life for every citizen. America now has the opportunity to create the information infrastructure required to achieve this.

A coordinated, focused drive for a national information infrastructure will enable us to more effectively and efficiently devote our collective talents to developing the competitive edge against other nations.

Other nations, including Japan, Germany, France, and Singapore are taking significant steps to upgrade their own infrastructures and have long-term plans in place to continue doing so. With U.S. industry and government working together as partners, we can build on our already strong lead in information technology to maintain our current lead, help us compete abroad, and improve our quality of life at home.

A coordinated, focused drive for a national information infrastructure will enable us to more effectively and efficiently devote our collective talents to developing the competitive edge against other nations. Working together toward a common goal, America will realize the benefits of an information infrastructure sooner — we will establish the standards the world will need to follow and we will be the first to market with important new products, services, and applications for the infrastructure. More importantly, we will be able to dramatically change the way Americans learn, care for the sick and elderly, and manufacture products.

The following descriptions provide a glimpse of the important benefits an information infrastructure could make possible.

Health Care

Americans spend more on health care than on any other industry, but they are getting less in return for their expenditures than is possible. For many people, health care is too expensive and often unavailable. CSPP believes that computing and communications technologies can provide solutions to both of these shortcomings.

Health care is a large, high growth, recession resistant industry, with spending rising about 2 1/2 times faster than GNP. In 1991, health care spending totalled $738 billion, or 13% of GNP, up from 7.3% of GNP in 1970. The Health Care Financing Administration projects that the nation's health outlays will reach $1.6 trillion by the year 2000. The soaring cost of health care has triggered concern about the ability of the nation to continue providing quality health and medical care as well as the ability of individual Americans to afford it.

Health care is extremely information intensive. Each year, Americans make approximately 636 million visits to doctors' offices for ambulatory care. In addition, 23 million surgical procedures are performed annually. Each visit and procedure generates large amounts of medical and financial data. There is presently no means to preserve or track that information for use in future or related health care situations. In fact, the cost of managing health care information is one of the prime causes of the increasing cost of health care.

Improving the management of this information through a health care information infrastructure will enable efficiency gains and cost savings throughout the entire health care process. First, roughly 20% of annual health care expenditures go to administrative costs, including processing an estimated five million health care claims per day. Computing and communications technologies offer new opportunities to improve the manage-